The Influence of Levees on the Stability of Chinook Salmon Spawning Habitat in the Cedar River

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We are using radio tags as scour monitors to measure the stability of chinook spawning habitat in confined and unconfined reaches of the Cedar River. Radio tags, encased in buoyant carriers, were buried 20 cm (8 in.) in the streambed to represent the averaged depth of a chinook salmon redd. Twelve scour monitors were placed in each of eight study reaches (96 total), four confined and four unconfined. We also installed tags adjacent to 9 chinook salmon redds. There were only two minor freshets during the winter of 1999/2000. One was approximately 2,500 cfs and the other was approximately 3,000 cfs. A total of 19 tags were scoured, 14 from unconfined areas and 5 from confined areas. Only one of the 9 tags placed adjacent to chinook salmon redds scoured. Tags in the upstream cross-sections (closer to the pools) scoured more frequently than those in downstream cross-sections (closer to the riffle). Scour appeared to be related to sediment size, with the frequency of scour being greatest in areas with mean sediment size (d50) less than 32 mm. Sediment in unconfined reaches was smaller than that in confined reaches where most of the mean sediment sizes were 45 mm and greater.

Stability of Chinook Salmon

Spawning Habitat in the Cedar

River

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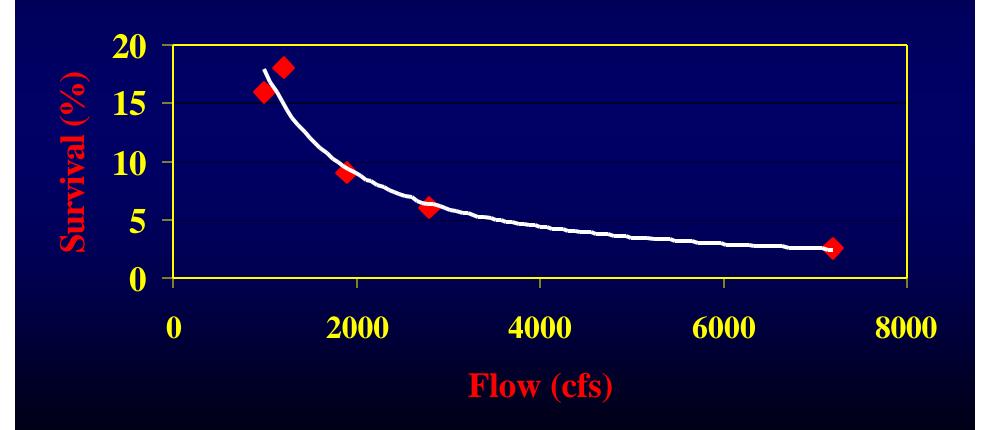
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Objectives

 Assess the stability of chinook salmon spawning habitat in the Cedar River

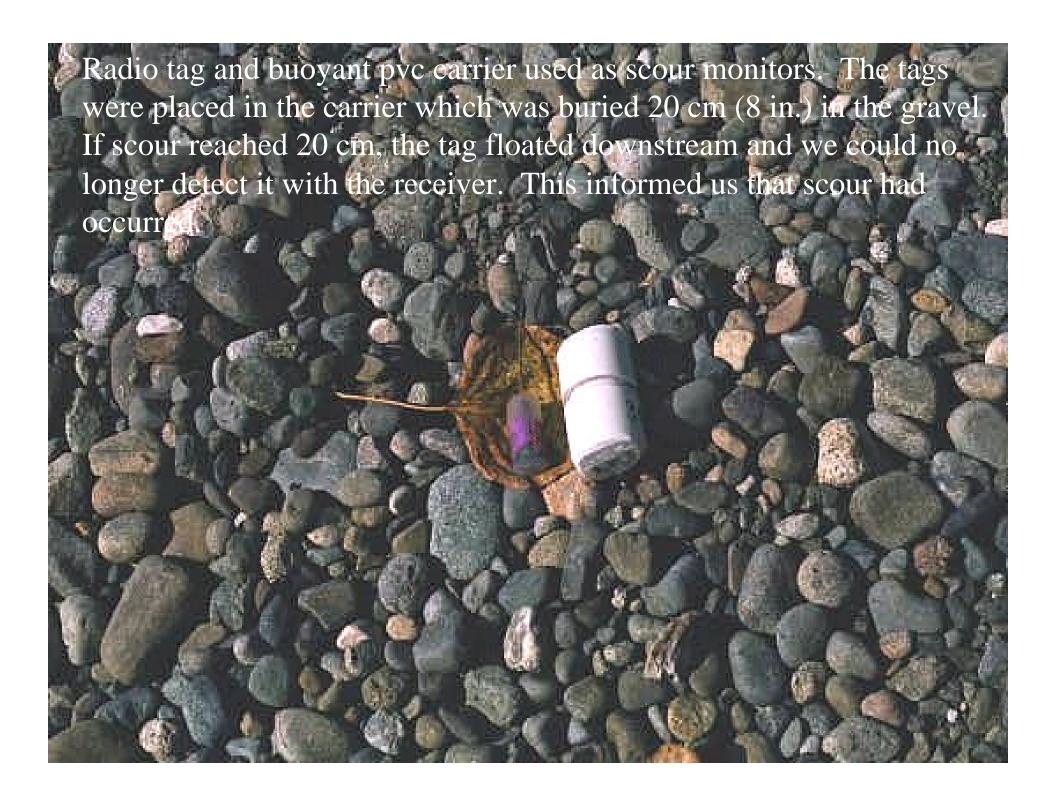
 Determine the influence of floodplain width on spawning habitat stability Incubation survival of sockeye salmon in the Cedar river compared with yearly high flow events (from Sieler, WDFW)

Cedar River Sockeye Incubation Survival

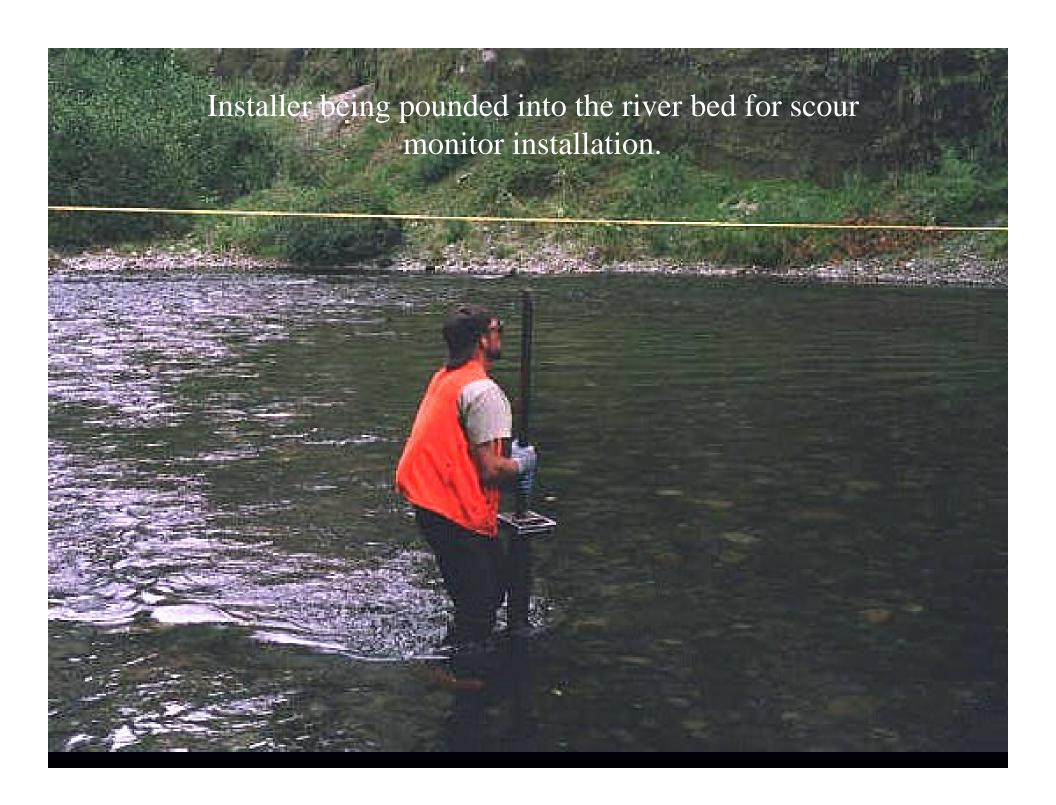


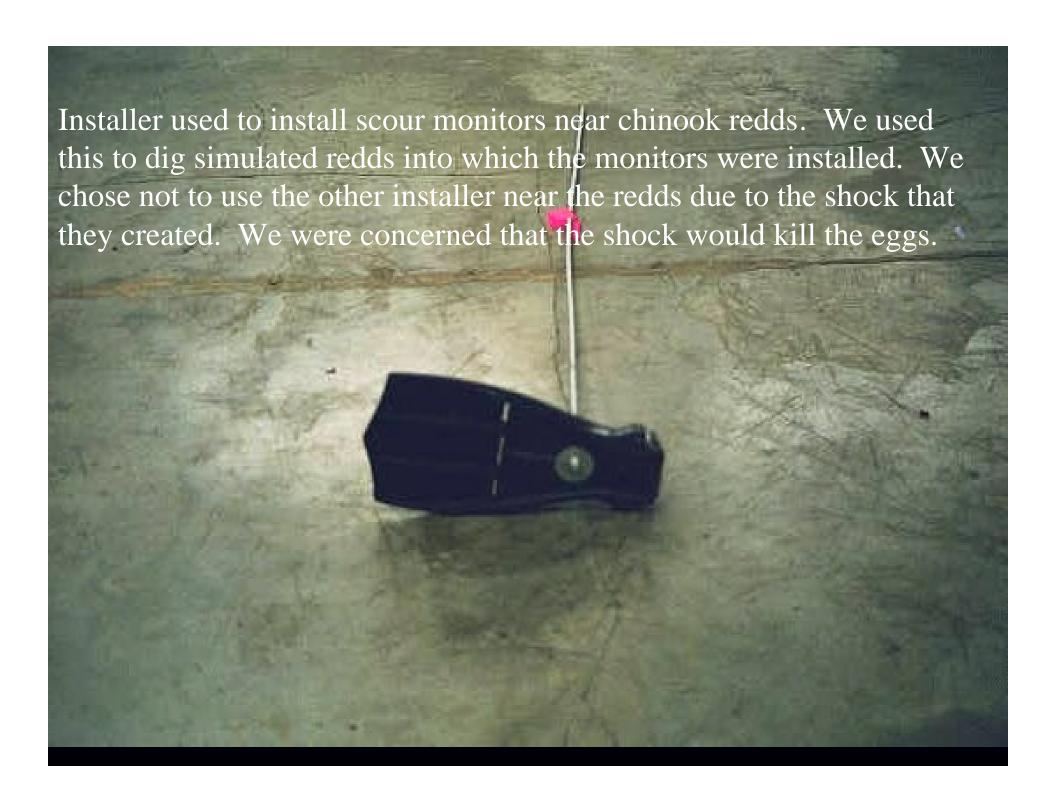
Study Design

- Eight study sites (Four confined by levees, four unconfined).
- Three transects at each study site, each with four scour monitors buried 20 cm deep.
- Survey cross-sections at each transect,
 longitudinal profiles, sample substrate.
- Monitor scour tags during high flows.

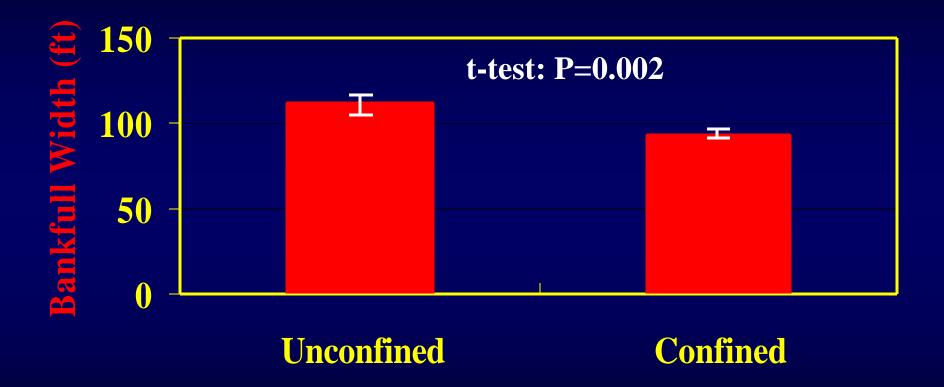






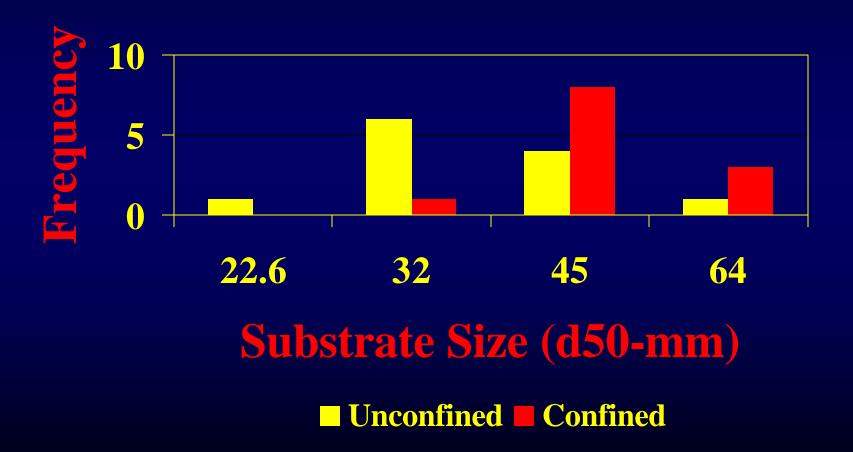


Comparison of bankfull width at unconfined and confined reaches. Unconfined reaches had a significantly wider bankfull width.



Mean sediment size (d50) at confined and unconfined reaches. The sediment was coarser in confined reaches than unconfined reaches.

Substrate Size



Results

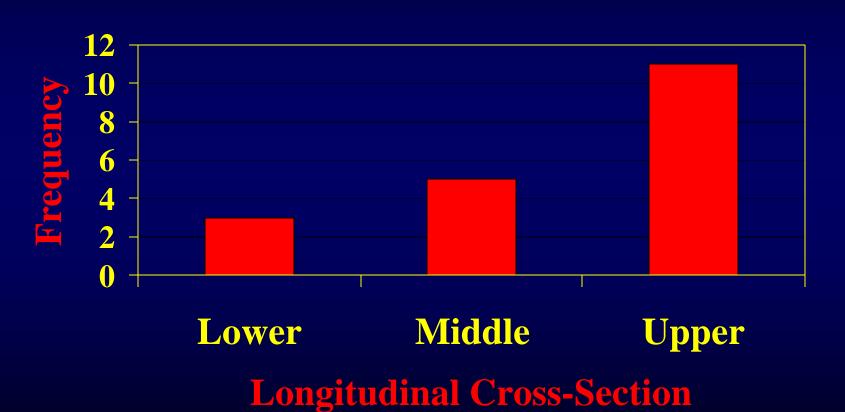
- Two minor freshets occurred
 - 11/24 approx. 2,500 cfs; 12/15 approx. 3,000 cfs
- 96 scour tags placed along 24 cross-sections at 8 study sites
 - 19 tags scoured (14 from unconfined areas and 5 from confined areas)

Results

- 9 scour tags placed adjacent to chinook redds
 - 1 tag scoured
- 10 scour tags placed for method comparison
 - 5 "fin" tags scoured (Approx. 2,000 cfs)
 - 3 "pounder" tags scoured (Approx. 2,500 cfs)

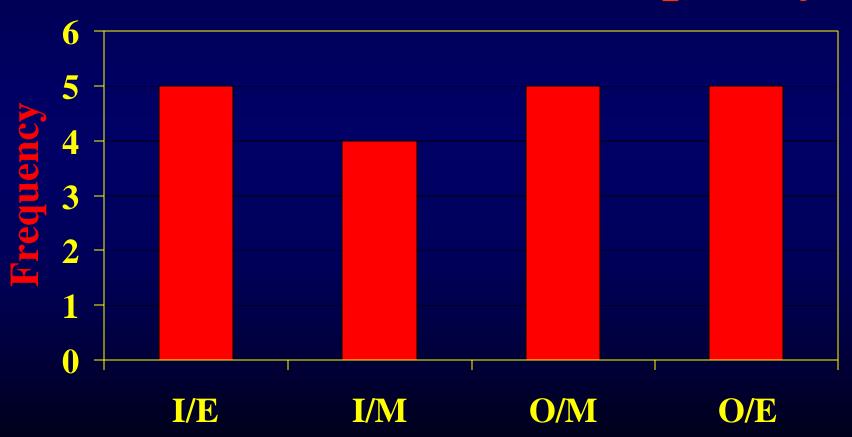
Frequency of scour at the lower, middle, and upstream cross-sections. More scour occurred at the upper cross-sections than the lower cross-sections.

Longitudinal Scour Frequency



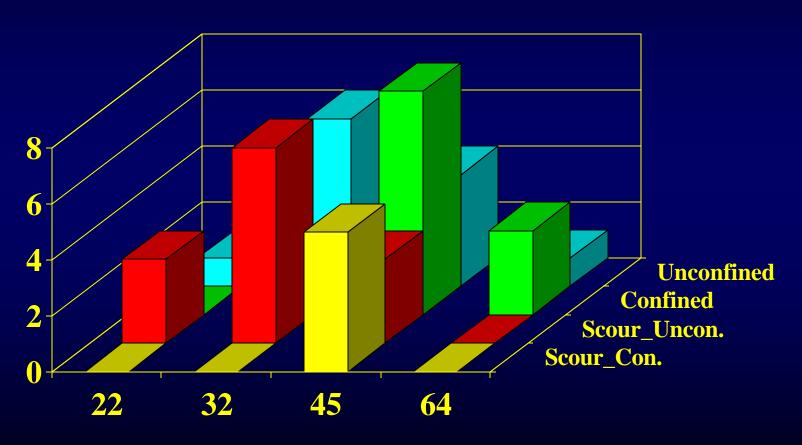
Frequency of scour across the cross-sections. There was no difference in the frequency of scour at the four sites (I/E – inner bend, edge; I/M – Inner bend, mid-channel; O/M – outer bend, mid-channel; O/E – outer bend, edge.

Cross-sectional Scour Frequency



Frequency of mean sediment size (d50) at confined and unconfined reaches and the frequency of scour that occurred at cross-sections with those mean sediment sizes.

Substrate Size



Conclusions

- Unconfined reaches have wider bank full areas
- Unconfined reaches have smaller substrate size
- More scour occurred in unconfined reaches –
 due to smaller substrate size
- More scour occurred in upstream crosssections than in downstream cross-sections

What's Next

- Repeat study in fall 2000
 - We've lost 9 tags thus far, 8 unconfined, 1 confined
- Modified design
 - Six transect with two tags
 - Tags placed on inside of bends near the bank
- New Questions What is the influence of larger substrate on egg depth?